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Research Article

Risk-Taking Behaviour and Criminal Responsibility: A Preliminary Investigation with Offenders and Forensic Psychiatric Patients

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ABSTRACT

The present study investigated whether individuals found criminally responsible (CR) differ from individuals found Not Criminally Responsible on Account of Mental Disorder (NCRMD) on behavioural measures of risk-taking. Risk-taking was measured using two computerized tasks, the Balloon Analogue Risk Task (BART) and the Iowa Gambling Task (IGT). CR individuals were hypothesized to show greater risk-taking behaviours compared to NCRMD individuals. Performance on the IGT and BART was also hypothesized to predict NCRMD or CR group membership. Thirty-eight forensic psychiatric patients and offenders participated in this study. A t-test and logistic regression were conducted to address these hypotheses. No significant differences in risk-taking were found between NCRMD and CR individuals on the IGT and BART. Further, performance on the IGT and BART did not predict NCRMD or CR group membership. These results suggest that NCRMD and CR individuals are similar in levels of risk and may be similar in other criminogenic needs that have not been studied here. Future research is needed to understand the extent to which the rehabilitative needs of forensic psychiatric patients and offenders overlap.

Keywords: Balloon analogue risk task; Iowa gambling task; Criminally responsible; Not criminally responsible on account of mental disorder; Risk-taking behaviour

INTRODUCTION

According to Section 16 of the Criminal Code of Canada [1], if an individual committed a crime while suffering from a mental disorder that rendered them unable to appreciate the nature of the crime or knowing that it was wrong, then that person should be found Not Criminally Responsible on Account of a Mental Disorder (NCRMD). In these cases, through a court-ordered assessment, the court is deciding that these individuals do not have the decision-making ability to have criminal intent at the time of their offence. These assessments are conducted by psychiatrists, and therefore pose the risk of being subjective in nature. The present study's objective is to investigate whether two objective measures of risky decision-making, the Iowa Gambling Task (IGT) and the Balloon Analogue Risk Task (BART), can be used predict whether an individual will be found NCRMD or criminally responsible (CR). The ultimate aim is to identify objective and easy-to-administer measures of risky decision-making, which would could potentially be supplemental to risk assessments.

For a person to be found CR for a crime in Canada, the court must prove both actus reus, or "guilty act" and mens rea, or "guilty mind". For actus reus to be supported, there must be sufficient evidence that an accused person committed the crime. For mens rea to be supported there must be sufficient evidence that the accused person intended to commit the crime [2]. Once there is sufficient evidence for actus reus, mens rea must be assessed. For individuals with serious mental disorders (e.g., schizophrenia) who committed crimes while ill, a court-ordered assessment of criminally responsibility is required to determine whether the mens rea condition is satisfied for the crime in question, termed the index offense. This assessment may require the accused person to be detained in a forensic psychiatric hospital and evaluated for several weeks to months [3]. If there is sufficient evidence that the index offense was caused directly by the symptoms of an accused person's mental illness, a recommendation will be made to the court stating that the accused person was unable to appreciate the nature and consequences of the index offense, and mens rea is not satisfied.

If an individual is found NCRMD by the courts and continues to pose a risk to society, then he/she will enter the forensic psychiatric system and receive psychiatric care to address the source of their criminal behaviour: their mental disorder. At times, the court-

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ordered assessment may discover that, while an accused person suffered from a mental illness, their illness did not preclude them from forming criminal intent (e.g., if an individual has schizophrenia, but the crime was intentional and not related to symptoms). For these individuals, both mens rea and actus reus conditions are met and he or she will be found CR, receive a sentence, and enter the correctional system [3].

Thus, the ultimate responsibility of the courts is to ensure actus reus and decide whether the accused individual had criminal intent at the time of the crime. Mens rea is the primary differentiating factor between those found NCRMD and those found CR [2]. For this reason, the decision-making processes of these two groups are expected to differ. Given that individuals found CR engaged in riskier behaviour and intended to engage in that behaviour, they are likely to engage in riskier decision-making processes.

Interestingly, although there is a foundational assumption that people found CR and NCRMD differ in their decision-making capacities, no studies to date have attempted to map out or understand these differences. Given that individuals found NCRMD did not intend to engage in their criminal behaviour, they are expected to have less "risky" decision-making tendencies, as their offending behaviour should not be tied to their "riskiness" (or willingness to take chances that may have significant consequences) but rather to symptoms of their mental illness. For example, an individual with schizophrenia may set a house on fire because he or she believed that a "higher power" told him or her to do so. This behaviour would not be due to that person's "riskiness", but to the symptoms of their mental illness. Further, it must be noted that healthy participants without any history of psychiatric diagnoses have shown consistent decision-making patterns across time points and measurement sessions, suggesting risky decision-making behaviour is generally robust over time [4].

Among those found CR, the risk factors most strongly and consistently related to criminal behaviour are termed the "Big 4" by Andrews and Bonta and include antisocial behaviour, antisocial personality pattern, antisocial cognition, and antisocial peers [5]. These risk factors also overlap with a diagnosis of antisocial personality disorder [6], which is highly prevalent among individuals found CR. In the prison population, APD is the most prevalent mental illness, with rates up to 60-80% [7]. Some studies have reported rates of mental illness up to 80-90% in the Canadian criminal justice system, overall, when APD and substance use disorder (SUD) are included in those definitions of mental illness [5]. Therefore, individuals with APD are prevalent in the CR population and are highly likely to continue to engage in risky behaviour.

In the forensic psychiatric system, 70.9% of individuals are diagnosed with a psychotic spectrum disorder, making this cluster of diagnoses the most common in this population [8]. These disorders are also associated with risk factors like poor family relationships, poor social support, social isolation [9], poor performance in school/work [10], and substance use [11], all of which are criminal risk-factors, but less strongly associated with criminal behaviour than the "Big 4" risk factors. Therefore, we would expect their "risk level" to be higher than the general population, but lower than people in the criminal justice system, on average.

The current study investigated impulsive risk-taking, rather than premeditated risk-taking, which will not be measured in this study. Impulsive risk-taking, which is more consistently related to criminality, can be characterized by a lack of self-control; a theory discussed by Gottfredson and Hirschi in their book, A General Theory of Crime [12]. They posit that low self-control is a risk factor for criminal behaviour, where higher self-control would be related to a reduced risk of committing impulsive criminal offenses. Their theory on crime was empirically supported in a meta-analysis conducted by Pratt and Cullen which included findings from 21 empirical studies. In general, self-control was consistently and strongly related to criminal behaviour, with no significant differences in effect sizes across sex and age groups (i.e., adult versus juvenile offenders) [13]. However, the theory that self-control is a risk factor for criminality is not distinct from Andrews and Bonta's risk factors of crime, as depleted self-control has been found to increase risk-taking behaviour [5,14]. Thus, while Gottfredson and Hirschi's general theory of crime is distinct from Andrew and Bonta's "Big 4" criminal risk factors, both viewpoints support the idea that risky behaviour is related to criminality [5,12]. Therefore, the current study is specifically measuring risk-taking as it relates to self-control and moment-to-moment decision-making (i.e., impulsive criminal behaviour), as opposed to premeditated risk-taking which does not involve a lack of self-control.

In the present study, risky decision-making behaviour was measured using two computerized tasks: the BART [15] and IGT [16]. The IGT was chosen as it is currently the most commonly used behavioural task of risky decision-making [4]. Created by Bechara and colleagues the IGT was designed to stimulate real-life, real time decision-making [16]. The BART was chosen for this study as factor analytic research comparing the BART and IGT has found that the two tasks are measuring different facets of decision-making, and that pairing the BART and IGT may improve the degree to which decision-making behaviours are fully assessed [4]. The BART has shown strong test-retest reliability across studies [15,17]. The test-retest reliability of the IGT is less consistent across studies: one study found moderate test-retest reliability, with IGT scores being consistent across the second and third session of the task, but not the first [17]; another study found strong test-retest reliability, with performance on the IGT being stable across separate time intervals [16]. The evidence that both the IGT and the BART have strong test-retest reliability [15-17] is important because many participants are completing these measures long after they committed their crimes (sometimes many years after), therefore, it is important to have evidence that decision-making profiles are consistent over time.

The present study aimed to empirically test the differences in decision-making processes of NCRMD individuals and CR individuals using the BART and IGT as measures of risky decision-making. Risk-taking has previously been both hypothesized and empirically supported as a predictor of criminal behaviour [5,12,13,18]. Further, symptoms of mental illness are inconsistently related to criminal behaviour [19], and cannot be considered as a strong risk factor for criminal behaviour. Since an NCRMD designation requires that an accused person's offense be directly caused by mental illness symptoms [1], symptomology would have to be the primary cause of crime in NCRMD cases instead of other risk factors (i.e., risky behaviour). This suggests that among individuals found CR, their offenses are more likely to have been a

product of risky decision making, while among individuals found NCRMD, their offenses should be a product of symptomology. Thus, the present study hypothesizes that CR individuals will show riskier decision-making tendencies than NCRMD individuals. Further, the present study hypothesizes that increased risk-taking will predict NCRMD or CR group designation. The ultimate goal of this study was to gather preliminary findings on and compare the riskiness of NCRMD and CR individuals and to test whether commonly used and easy-to-administer measures of riskiness can be used to predict a verdict of NCRMD. This research is an important contribution to the literature, as it may assist in the assessment of criminal responsibility and may offer an overview of the current behavioural risk profiles of both groups, so that they may be compared and possibly incorporated into rehabilitative interventions among both populations.

METHODS

The present study was conducted at a medium-security forensic psychiatric hospital in Ontario, Canada. This study has received ethics approval by Lawson Health Research Institute and the Research Ethics Board at the University of Western Ontario (REB #107052).

Participants

All participants in the NCRMD group were under custodial dispositions because their mental illness was continuing to contribute to their level of risk to society. Participants who were undergoing assessment in the hospital were also recruited. These participants did not yet have a designation assigned to them. They were recruited while in the hospital and were later found either CR or NCRMD. Those found CR were placed in the CR group. Those who had already been found NCRMD, or who were later found NCRMD after assessment, were placed in the NCRMD group.

Demographics

Data from 38 participants was included in this study. Ages ranged from 20 to 66 years (M = 35.16, SD = 2.77). Participant gender, race, and diagnosis are broken down in Table 1. All participants except two had two or more concurrent psychiatric diagnoses.

Recruitment

Fifty-seven participants were recruited for the present study, 38 of which fully completed at least one of the two tasks and had sufficient demographic data available to participate in the study. Participants were eligible to participate if they were/had;

(1) A patient at a forensic psychiatric hospital;

(2) Normal or corrected-to-normal vision;

(3) Fluent in English;

(4) Able to respond verbally or in writing to questions; and

(5) Capable of providing consent to participate in the study.

The ability to use the keyboard or mouse of a computer (as the tasks were computer-based) to answer questions and complete tasks was not an inclusion criterion, as participants who were unfamiliar with computers or did not want to use a keyboard or mouse were assisted in completing the computerized tasks. Participants were recruited by nurses, based on whether they met the inclusion criteria, and whether they were interested. Researchers then approached the pre-screened patients.

Table 1: Sample demographic and diagnosis breakdown (N=38).

Factor	Percentage (%)
Gender	
Male	97
Female	3
Race	
White	82
Aboriginal	13
South East Asian	3
East Asian	3
Diagnosis	
Psychotic spectrum disorder	78
SUD	81
Personality disorder	30
Mood disorder	27
Anxiety disorder	11
Substance-induced psychosis	8

Given the many limitations of conducting research with the forensic psychiatric and offender populations (refer to the Limitations section), the recruitment process posed a number of challenges, thereby severely limiting our sample size. Many patients did not want to participate due to mental illness symptoms, such as feelings of fatigue, lack of motivation, or paranoid thoughts. Participants often chose to discontinue participation, often due to these symptoms, leading to a number of participants with missing data. Further, as forensic psychiatric wards often have limited patients with very slow turnover, a limited number of participants could be recruited in any one year.

PROCEDURES

Participants were provided with a letter of information (Appendix A), which provided them with an overview of the study and informed them that all the data being collected was confidential, anonymous, will not be shared with the hospital, will not affect discharge dispositions, and cannot be used in the court of law. Participants were also informed that they could withdraw from the study at any point. All participants signed a consent form before beginning the study (Appendix B). They then completed several questionnaires presented on Qualtrics and complete computerized measures of risky decision making using PEBL software (Version 1.4). Upon completion of the study, participants were debriefed. Participants were given a refreshment of their choosing (a carbonated beverage, tea, or coffee) as incentive for participation. Each participant received a unique participant code to anonymize their data. Anonymized participant data were stored on an encrypted and password protected computer.

MEASURES

Background form

A background form was completed for each participant using the patient files kept at the hospital following their completion of the computerized tasks. Background forms included;

(1) Demographic information (e.g., sex, age, ethnicity, date of birth);

(2) Psychiatric diagnoses;

(3) Information on whether the person was found CR or NCR. Participant codes, but not names, were included in the background forms. Only the variables directly relevant to the present hypotheses will be discussed in this manuscript.

Measures of risk-taking

The Iowa gambling task: The IGT is a computerized decision-making task that simulates real-life decision-making as it involves uncertainty in the outcomes of decisions and factors in reward and punishment [16]. Participants are presented with four decks of cards (decks A, B, C, and D), from which they must choose one card at each of the 100 trials. Each card selection earns the participant some fictitious money and participants may also lose money on each trial. The four decks vary in the amount of money earned and lost. Decks A and B are "riskier" because the participants win more money on each trial but can also lose more money on each trial compared to decks C and D. Choosing decks A or B guarantees a $100 gain, but also risks a $1250 loss, making these decks "riskier". Choosing decks C or D guarantees a $50 gain, but only risks an occasional $50 loss, making these decks less "risky". The participant's goal is to collect as much money as possible across the 100 deck selections. Participants who select cards from decks A and B will ultimately lose more money than if they had selected cards from C and D [16].

The Balloon Analogue Risk Task (BART): The BART is a paradigm that measures risk-taking behaviour by balancing hypothetical monetary gains with increasing risk [15]. Participants are instructed to blow up a balloon by pressing on the "pump" button. Each pump gains the participant more fictitious money. Participants are instructed to pump up the balloon as many times as they can before it pops, and to collect their money before it pops. If the balloon pops before they are able to collect their money, they lose the money for that trial. The task consists of 60 balloon trials, and 20 of the 60 trials are either high (5.0 cents/pump), medium (1.0 cent/pump), or low (0.5 cents/pump) payoff. Each trial involves the computer screen displaying a small balloon, a balloon pump, a "Collect $$$" button which resets the balloon and collects the money earned from the pumps, a box displaying total money earned, and a box displaying money earned from the previous balloon [15].

There are three colours of balloon, each with different levels of risk. Orange balloons are the riskiest and pop within a few pumps. Yellow balloons are also risky but may be blown up more than the orange balloons before popping. The blue balloons are the least risky and may be blown up anywhere from five to over 10 times before popping [15]. The BART also assesses learning behaviour in addition to risk-taking, as the participants' ability to realize which balloons are the riskiest and to change their behaviour accordingly can also be assessed. A participant who collects less money would also be one who perseverated in being liberal when blowing up risky balloons, and thus lost money before collecting. Thus, the less money earned at the end of the task, the riskier the participant's decision-making profile [15].

Predictions

In line with the hypothesis that CR participants will show riskier behaviour than NCRMD participants, this study has two predictions:

1. CR participants will be riskier on the IGT and BART than NCRMD participants.
   - On the IGT, CR participants will have a lower ratio of "not risky" decks (C and D) to "risky" decks (A and B) on average compared to NCRMD participants, where lower ratio values indicate greater risky behaviour.
   - On the BART, CR participants will have a higher average number of balloon pumps prior to money collection than NCRMD participants, where greater average values indicate greater risky behaviour.
2. Riskiness on the IGT and BART will predict CR or NCRMD group designation.
   - On the IGT, the likelihood of receiving a CR designation will increase as the ratio of "not risky" decks (C and D) to "risky" decks (A and B) decreases.
   - On the BART, the likelihood of receiving a CR designation will increase as the average number of balloon pumps prior to money collection than increases.

Statistical analysis

For the present study, IBM SPSS Statistics Version 25 was used for statistical analysis. NCRMD and CR participants' choices of "non-risky" and "risky" decks across five 20-trial blocks of the IGT were graphed to provide visual information on changes in deck choice over the five IGT blocks. Ratio of "non-risky" to "risky" decks on the IGT has the disadvantage of not reflecting the change in deck preferences across trials. Many studies report the IGT outcome measures in blocks of 10–20 trials, which are entered in a Block × Group analysis of variance. These procedures often involve collapsing the choice proportions over decks C and D, and over decks A and B [19-21].

Riskiness was operationalized on the IGT by the ratio of "non-risky" (C and D) to "risky" (A and B) decks, where higher values indicate greater "non-risky" deck choices. Many studies using the IGT examine either the overall proportion of choices from the "non-risky" compared to "risky" decks, or a difference score between the overall choices from the "non-risky" and "risky" decks e.g., [22,23]. An overall proportion of choices from the C and D decks larger than 0.50 or a positive difference score (i.e., decks C and D chosen more overall) indicate non-impaired performance in that individual [24,25]. For the BART, the average number of balloon pumps prior to money collection was chosen to operationalize riskiness as it was the common variables of interest in prior research examining risk-taking with the BART [26,27].

A Levene's test for the homogeneity of variances was first conducted to test whether equal variances could be assumed for the NCRMD and CR groups. To test the first prediction, a t-test was conducted to investigate whether NCRMD individuals are significantly different from CR individuals in riskiness on both the IGT and BART. To test the second prediction, a binary logistic regression was employed with the IGT and BART variables added

into a model to predict NCRMD and CR group membership. The logistic regression computed the increase in probability of an individual being found NCRMD or CR given a one standard deviation increase in riskiness. An alpha level of 0.05 was used to judge the statistical significance of findings for both the t-tests and logistic regression.

RESULTS

Descriptive statistics

Descriptive statistics were computed for the NCRMD and CR group for a number of IGT and BART variables (Table 2). NCRMD and CR participants were also compared on their choices of "non-risky" and "risky" decks across five 20-trial blocks of the IGT (Figures 1 and 2). On average, the NCRMD and CR groups are visually similar for both "non-risky" and "risky" deck choices across all five blocks of the IGT.

Independent samples t-test

A two-tailed independent samples t-test was conducted to test the first prediction that CR individuals will show greater risky behaviour than NCRMD individuals on the IGT and BART. For the IGT, a t-test was run to examine whether NCRMD individuals had a significantly higher ratio of non-risky decks (C and D) to risky decks (A and B) on the IGT than CR individuals. A Levene's test for the homogeneity of variances was not significant, $F(1, 33) = 0.96$, $p = 0.334$, suggesting the variances of the two groups, CR and NCRMD, on the ratios of decks C/D to A/B were not significantly different; the assumption for homogeneity of variances was not violated. Contrary to the first prediction, there was no statistically significant difference between CR ($M = 1.17$, $SD = 0.55$) and NCRMD ($M = 1.38$, $SD = 1.63$) individuals on the ratio of non-risky to risky decks chosen on the IGT ($t(33) = -0.465$, $p = 0.645$).

For the BART, a t-test was also conducted to examine whether CR individuals, compared to NCRMD individuals, will have a significantly higher average number of balloon pumps prior to money collection. A Levene's test for homogeneity of variances was not significant, $F(1, 35) = 1.51$, $p = 0.228$, thus equal variances was assumed. Again, inconsistent with the first prediction, there was no statistically significant difference between CR ($M = 9.98$, $SD = 6.16$) and NCRMD ($M = 10.94$, $SD = 10.94$) individuals on the average number of balloon pumps prior to money collection on the BART ($t(35) = -.384$, $p = 0.703$).

Binary logistic regression

The dependent variable, criminal responsibility, indicates whether someone has been found CR or NCRMD. Since an individual is necessarily either found NCRMD or CR for an index offense, and never both, criminal responsibility is a discrete variable. Criminal responsibility was coded such that CR was equal to 0 and NCRMD with was equal to 1. A binary logistic regression was conducted to create a model whereby risky decision-making on the IGT and BART add to the prediction of CR or NCRMD group membership (Table 3).

To test the second prediction that risky decision-making would predict CR or NCRMD group designation, first, a binary logistic regression was conducted with each predictor separately, and then with both in the same model. A model whereby ratio of decks on the IGT is included as the independent variable fit the data well, however the variable included did not significantly add to the prediction of group membership. Next, a model whereby the average number of pumps prior to collecting money on the BART was tested. Again, this model fit the data well, however the variable included did not significantly add to the prediction of group membership.

To test whether the additive effect of both variables significantly predicted group membership, a two-predictor binary logistic regression analysis was conducted with two independent variables, the ratio of C/D to A/B decks on the IGT and the average number of pumps prior to collection on BART. Neither ratio of C/D to A/B decks on the IGT, nor average number of pumps prior to collection on BART significantly predicted CR and NCRMD group membership.

DISCUSSION

The present study compared risky decision-making in forensic psychiatric patients, who have been found NCRMD, and offenders, who have been found CR. Given NCRMD individuals' offenses were caused by mental illness symptoms, criminogenic risk factors, including risk-taking, presumably played less of a role in their offending behaviour than CR individuals, whose offenses were not caused by mental illness symptoms. By this rationale, the

Table 2: Descriptive statistics comparing NCRMD and CR individuals on BART and IGT variables.

Variables	Not Criminally Responsible				Criminally Responsible			
	M	SD	N	Range	M	SD	N	Range
IGT								
Ratio of C/D to A/B	1.38	1.63	21	[0.23, 8.09]	1.17	0.55	14	[0.49, 2.23]
Net winnings	-341.64	957.39	22	[-2500, 1600]	-373.21	765.69	14	[-1800, 1250]
Risky Decks (A/B)	51.59	19.325	22	[19, 100]	50.93	10.92	14	[33, 69]
Non-Risky Decks (C/D)	48.05	10.916	22	[0, 81]	49.07	19.325	14	[31, 67]
BART								
Average # pumps before money collection	10.94	8.24	22	[2.30, 28.44]	9.98	6.16	15	[1.18, 23.73]
Total money earned	25.32	13.36	22	[8.40, 50.75]	24.44	13.61	14	[4.70, 56.95]
Total pumps	761.23	468.05	22	[207, 1609]	688.57	387.17	14	[109, 1544]
% explosions	41.87	14.93	22	[11.11, 72.22]	39.37	12.34	14	[11.11, 56.68]

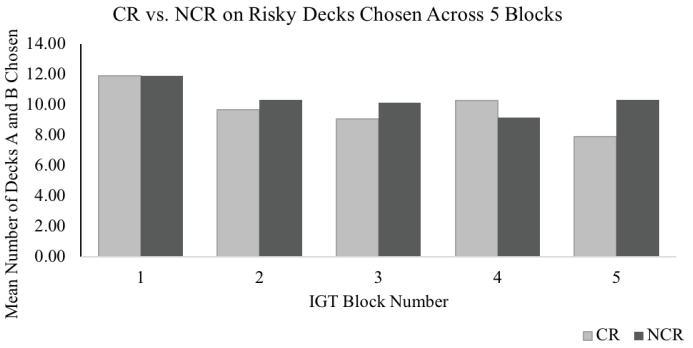

Figure 1: Trends of mean decks A and B chosen on the IGT across 5 blocks of 20 trials.

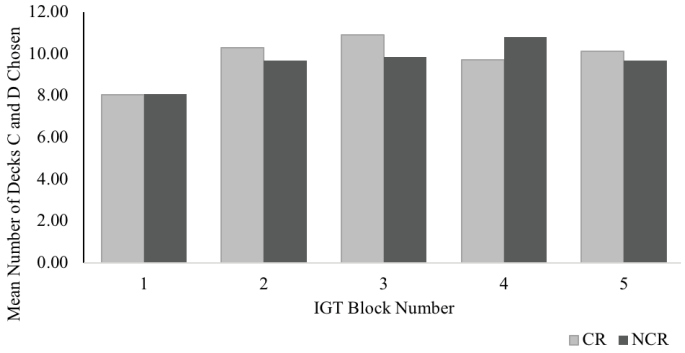

Figure 2: Trends of mean decks C and D chosen on the IGT across 5 blocks of 20 trials.

Table 3: Three-step binary logistic regression using IGT and BART variables as predictors of NCRMD and CR group

Variables	β	$\beta_{S.E.}$	Wald's (χ^2)	df	p-value	Odds Ratio (OR)
Step 1						
IGT_{Raio}	0.147	0.318	0.214	1	0.643	1.159
Constant	0.220	0.520	0.179	1	0.673	1.246
Step 2						
$BART_{AvePumps}$	0.018	0.047	0.155	1	0.694	1.019
Constant	0.191	0.589	0.105	1	0.746	1.210
Step 3						
IGT_{Ratio}	0.189	0.329	0.330	1	0.566	0.984
$BART_{AvgPumps}$	0.016	0.054	0.088	1	0.767	1.208
Constant	0.282	0.684	0.169	1	0.681	1.325
Goodness-of-fit test			χ^2	**df**	**p-value**	
Hosmer and Lemeshow (Step 1)			11.62	7	0.114	
Hosmer and Lemeshow (Step 2)			6.861	7	0.443	
Hosmer and Lemeshow (Step 3)			8.727	8	0.366	

present study hypothesized that NCRMD and CR individuals will be different in riskiness, where CR individuals would be riskier than NCRMD individuals. Further, the present study hypothesized that level of risk would predict the NCRMD verdict, with greater riskiness predicting CR group designation.

First, t-tests were conducted to test whether NCRMD and CR participants were different on measures of risk-taking. Discordant with the present study's hypotheses, NCRMD and CR participants were not significantly different on risk-taking. As no studies have previously examined the differences on behavioural risk-taking measures in NCRMD and CR individuals, these results cannot be compared to previous findings. Many factors may have contributed to why CR participants were not found to be riskier than NCRMD participants. If a difference in riskiness does exist between the forensic psychiatric and offender populations, the present study may not have had a sufficiently large statistical power to detect this potential difference (discussed further in the limitations sections below). However, if these results are indicative of behavioural riskiness among individuals found NCRMD and CR, then the forensic psychiatric and offender populations may overlap more greatly than initially anticipated in their rehabilitative needs. Indeed, one study found that up to 47% of NCRMD individuals had at least one prior conviction [8]. This would indicate that many forensic psychiatric patients have also been offenders in the past, and so the forensic psychiatric population may not be easily separated from the offender population in terms of their overall risky behaviour.

Second, a three-step binary logistic regression was conducted to test whether performance on the IGT and BART would significantly predict an NCRMD verdict. In discord with the present study's hypothesis, riskiness on the IGT and BART did not significantly predict NCRMD or CR group membership. Again, these are preliminary findings, so these results cannot be compared to previous research findings.

NCRMD and CR participants were compared on their choices of "non-risky" and "risky" decks across five 20-trial blocks of the IGT. When these blocks were compared on a graph, the NCRMD and CR groups were visually similar for both "non-risky" and "risky" deck choices across all IGT blocks. If there is no significant difference between NCRMD and CR participants on riskiness, as was revealed by the t-tests conducted and Figures 1 and 2, then performance on the IGT and BART should not significantly predict NCRMD or CR group membership, as was confirmed by the binary logistic regression.

While results from the binary logistic regression suggested that performance on the IGT and BART did not predict NCRMD or CR group membership, computerized behavioural tasks that measure risky decision-making should be further studied as potential measurement tools for riskiness in the forensic psychiatric and offender populations. Behavioural tasks have an advantage over self-report in measuring risk in that they are objective, do not require language competency, and are fairly simple to complete. Further, the IGT and BART do not require a clinician to administer them, and so more individuals may complete them more easily and with the use of fewer resources. If adequate research is done to determine behavioural tasks that reliably measure risk, perhaps computerized tasks could be incorporated into risk assessments to provide objective measures of risk in a more efficient manner.

Implications

As a there was no detected difference in risky decision-making between NCRMD and CR participants, the present studies' findings suggest that the forensic psychiatric population may overlap with the offender population more than originally predicted. If these two populations do in fact largely overlap, such that forensic psychiatric

patients cannot be reliably distinguished from the offender population on behavioural measures of risk, then they may also largely overlap in other criminogenic risk factors. Criminogenic needs, such as antisocial personality patterns, substance use, family and peer relationship dynamics, employment, and leisure activities, have already been identified as dynamic risk factors in offenders which should be targeted in treatment to prevent recidivism. Targeting these criminogenic needs during treatment may aid in the rehabilitation of forensic psychiatric patients with SUD and personality disorders. While psychotic spectrum disorders are by far the most common diagnoses, affecting about 71% of NCRMD individuals, SUDs affect about 31% and personality disorders affect another 11% of NCRMD individuals [8]. These prevalence rates, as well as the findings of the present study, suggest that addressing criminogenic needs in treatment may be beneficial in the forensic psychiatric population. Indeed, Crocket et al. found that a comorbid diagnosis of SUD or personality disorder increased the risk of reoffending in NCRMD people. If future research can identify the extent to which criminogenic needs are present among forensic psychiatric populations, then these needs may be actively addressed in treatment, as well as in the community once the NCRMD patient has received a conditional or absolute discharge.

Further, since nearly half of forensic psychiatric patients have at least one prior offense [8], this may indicate that there should be continued and increased rehabilitative efforts in correctional facilities to address mental illness among offenders, in addition to criminogenic needs. As APD and SUD are by far the most commonly diagnosed mental disorders among offenders, and antisocial personality pattern and substance use are criminogenic risk factors [5], the criminogenic and mental health needs of offenders are interrelated. Beyond APD and SUD, one study found that about 14% of offenders in Western countries have some psychotic spectrum disorder or major depressive disorder [28].

While serious mental illness does not predict criminal behaviour when other criminogenic needs are taken into account, there are third-variable factors which connect crime and mental illness [29]. For instance, individuals with a serious mental illness are significantly more likely to experience homelessness, which has been cited as an important pathway to incarceration among the mentally ill [30]. Therefore, while criminogenic needs should continue to be addressed in offenders, increased mental health resources in correctional facilities and would work to address both criminogenic needs and third-variable factors related to mental illness.

Limitations

There were several limitations to this study which may have contributed to the hypotheses of the present study not being supported and should be accounted for in future research. A number of challenges emerged as a result of the population being studied. Most, if not all, inpatients at the hospital were taking medications and may have been experiencing side effects, such as sedation and fatigue, during the study, which may have influenced performance on the IGT and BART. Antipsychotic medications are one of the commonly prescribed drugs in the forensic psychiatric population due to the high prevalence of psychotic spectrum disorders. Antipsychotics vary in their degree of sedative effects, and these sedative effects have been reported to impede cognitive performance [31]. Further, many participants may have been coping with symptoms of serious mental illness at the time of the study, which may have further influenced their performance. Serious mental illness is commonly and persistently accompanied with cognitive impairments, which may impair an individual's functioning [32]. These cognitive impairments may involve problems with working memory, learning, and executive functioning [32]. As both the NCRMD and CR groups would have been experiencing similar challenges with medication side effects and mental illness symptoms at the time of the study, this limitation would not have impeded our ability to detect a difference in risk-taking on the IGT and BART, if a difference existed. However, said challenges may have lowered the overall performance on the IGT and BART in both groups, such that there would be inadequate variation in performance to detect a difference if one existed.

Given such challenges, the first and most obvious limitation was that the sample size for this study was low, with data from only 38 participants being used in statistical analysis. If the effect size of the difference between these two groups (if one exists) is small, the sample size would preclude sufficient statistical power to detect this effect. For very small effect sizes (e.g., 0.1), sample sizes of over 1000 are often necessary to reach an 80% chance of detecting that effect (based on power analyses using G*Power 3.1). Unfortunately, it is challenging to recruit a large number of forensic psychiatric patients, as approximately 2000 exist in all of Canada [8].

Another limitation was that the incentive used for participating in the present study was a beverage of the participant's choosing (i.e., carbonated beverage, coffee, tea); participants did not win the money they were trying to make on the BART and IGT. Given that the incentive was guaranteed as soon as the patient agreed to participate, the beverage of choice functioned to increase participation, but not to increase quality of participation. Often, participants appeared bored or tired during the tasks and appeared to make decisions carelessly or randomly in order to complete the tasks as quickly as possible. Again, feelings of boredom, fatigue, restlessness, and inattention may be products of medication effects or mental illness symptoms. If a small monetary gain was awarded in proportion to the money won on these tasks, it may have increased the chances of the participants completing the tasks more thoughtfully, consequently increasing the accuracy of their performance on these tasks to their true decision-making profiles. A review of the IGT data show that participants had an approximately 50% chance of choosing either a good or bad deck. Therefore, there is no evidence that participants were being strategic in their responding and may have been randomly selecting cards. Further, all participants ultimately lost more money than they won. Although this could be a sign of impaired decision making, the finding that participants were not selectively choosing bad decks, would undermine this conclusion, and rather point to possible disinterest or random selection of decks.

Another potential limitation is that the results of the present study may not be representative of the entire forensic psychiatric population. The present study gathered data only from individuals who agreed to participate and completed at least one of the two tasks. This means that the results may only represent individuals who are able to attend to the tasks for long enough to complete them, and to those who feel adequately motivated to participate. Many symptoms of psychotic spectrum disorders, which are by far

the most prevalent disorder in forensic psychiatric populations [8], may prevent individuals from participating. For instance, one individual declined to participate due to his feelings of paranoia towards sharing personal information, despite being told that the data would be completely confidential and anonymous. Negative symptoms of schizophrenia, as well as symptoms of depression (e.g., amotivation, fatigue) may have prevented a number of individuals from participating as they may have simply lacked the energy to participate. Therefore, there may be a subset of forensic psychiatric patients whose risk-taking behaviours were not measured and thus not accounted for because their symptoms may have prevented them from being suitable for recruitment, agreeing to participate, or completing the study. While such a limitation is difficult to amend for ethical reasons, it does point to a possible underrepresentation of the range of performance in the NCRMD population.

Finally, NCRMD and CR participants may further overlap in that all individuals in both groups necessarily had some mental illness during participation. Both NCRMD and CR participants must have received a court ordered assessment that would result in them becoming inpatients at a forensic psychiatric hospital, and so the index offenses of participants who were later found CR were suspected to have been caused by mental illness symptoms. Therefore, the CR group in this study may have been more similar to the NCRMD group in terms of their diagnostic profile compared to the general CR population found in jails and prisons. While 90% of offenders in the prison population have been diagnosed with a mental illness [5], APD or SUD diagnoses rates have been estimated to be as high as 60-80% [7]. As diagnoses of APD and SUD cannot result in an NCRMD verdict in Canada [33], individuals with these diagnoses would generally not be eligible for an assessment in a forensic psychiatric hospital (unless they also experienced comorbidities that were eligible). In the present study, no participants had a personality disorder diagnosis alone, and four had SUD diagnosis alone (after other diagnoses were ruled out). All of these participants were found CR. While forensic psychiatric and offender populations do overlap in mental health needs, offenders who received court-ordered assessments and were found CR may be more similar in diagnostic background to NCRMD individuals than offenders who were never NCRMD-accused. If this is indeed the case, then CR participant performance on the IGT and BART may not be adequately representative of the offender population.

FUTURE DIRECTIONS

Moving forward, future research comparing forensic psychiatric and offender populations should address the limitations of the present study, as well as compare these populations on other criminogenic risk factors outside of risk-taking to further the knowledge on the similarities and differences between offenders and NCRMD individuals. To address this study's limitations, firstly, further research using the data collected in the present study will include time spent in hospital and number of previous offenses in analysis. These variables were collected in the participant background forms but were beyond the scope of the present study, and so were not included in data analysis.

Second, future studies that wish to use the BART or IGT to assess riskiness should use monetary incentives in proportion to money won on these tasks, as monetary gains may help ensure that performance on these tasks is most accurate to the participant's true "riskiness". This is already being done with research using the IGT to study risk-taking in other adult populations [34-38].

Third, future research should include prison population to represent offenders, instead of inpatients at a forensic psychiatric hospital who are found CR. This may potentially function to separate these two populations more than may have been achieved in this study and may provide a truer representation of riskiness in an offender population. Further, future studies should also include a control group as a third comparison group, allowing a comparison of riskiness in forensic psychiatric and offender populations to individuals who have not encountered the criminal justice system.

Finally, future research endeavors comparing forensic psychiatric and offender populations should investigate other criminogenic risk factors, such as antisocial personality patterns, substance abuse, turbulent interpersonal relationships, and difficulty maintaining employment. These risk factors, which increase the likelihood of recidivism [39], are dynamic and thus subject to change through treatment. These risk factors should be further studied in the forensic psychiatric population to examine the extent to which they influence criminal behaviour in this population. As forensic psychiatric patients already receive psychiatric treatment for the mental illness symptoms, targeting criminogenic needs may be a useful addition in treatment to prevent recidivism.

CONCLUSION

The extent to which criminogenic needs differentially influence forensic psychiatric and offender populations should be further examined. This would include investigating where the rehabilitative needs of forensic psychiatric patients and offenders converge and diverge. The results of the present study seem to suggest that risk-taking behaviour is one point of convergence in the criminogenic needs of NCRMD and CR individuals. However, these are only preliminary findings, and far more research must be conducted comparing forensic psychiatric and offender populations such that rehabilitation efforts in these populations can be further specified to their respective needs.

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